

Chapter 3: Decomposing the Change in Medicare Expenditures for Physicians' Services

In order to decompose the changes in expenditures described in Chapter 2 into components attributable to factors such as the age/gender mix of the Medicare population, we examined the use of physicians' services by the sample of beneficiaries included in the Medicare Current Beneficiary Survey (MCBS) in detail. Beneficiaries in the MCBS sample, which we describe and analyze below, had annualized per capita spending on the services included in the statutory definition of physicians' services that increased 15 percent from \$960 to \$1108 over the period 1993-1998.¹⁷

We conducted analyses of the determinants of this increase in the expenditures for physicians' services in the Medicare program over the period 1993-1998. Total expenditures for any class of good or service are the sum of the quantities (volume) of the goods or services multiplied by their prices. In the context of the Medicare program, total expenditures for physicians' services can be represented as follows:

$$(1) \text{ Total expenditures} = \sum_i \text{Volume}_i * \text{Price}_i \text{ where services are indexed by } i.$$

Changes in total expenditures are thus functions of changes in the volume of services delivered, changes in the price of such services, and any interactions between these factors. To determine the causes of this increase in per fee-for-service beneficiary spending on physicians' services, we first looked at changes in prices and coverage policy that influenced spending. We then looked at changes in the volume and intensity of services delivered. We concentrated on the use of and spending for services on the physician fee schedule but also discuss the other services that are included under the statutory definition of Medicare physicians' services below.

Policy Changes in Prices and Coverage Rules

Policy changes that affect Medicare spending on physicians' services are of two types: changes that affect the price paid per service and changes in the services covered.

Each year updates to the dollar conversion factor used to set payment rates are published in the *Federal Register*. As shown in Table 6, the conversion factor increased from \$31.30 for nonsurgical services and \$32 for surgical services in 1993 (weighted average is \$31.48) to \$36.70 for all services in 1998. This represents an increase of 16.6 percent in the amount paid per relative value unit of service delivered. (The dollar conversion factor is calculated using the methods described in the section on Expenditure Trends in the previous chapter.)

It should be noted, however, that this does not translate directly into an increase of 16.6 percent in the price per unit of service delivered. The main reason for this is beneficiary cost-sharing: the average amount that Medicare paid per RVU was approximately \$23 when the 20

¹⁷ This increase was less than the per capita increase in total Part B spending reported in the National Health Accounts and the increase in physician fee schedule spending per enrollee reported by Medicare. This is because the National Health Accounts include spending on a wider set of services than those included in the statutory definition of physicians' services and the fee schedule spending includes a narrower set of services. Some of the public figures may also include spending for managed care enrollees. In addition, there is a sampling error of plus or minus approximately \$20 in the MCBS figures.

percent Medicare coinsurance and the Part B deductible of \$100 are taken into account.¹⁸ In addition, there are differences resulting from the phase-in of the RBRVS fee schedule, the treatment of nonphysician providers, and the geographic adjusters. The physician fee schedule was not completely phased in until 1996, so providers in localities where the historical payment amount for a service was less than 85 percent or more than 115 percent of the fee schedule amount were paid a blend of the fee schedule amount and the historical payment amount. Also, nonphysician providers are reimbursed under the physician fee schedule but are paid a percentage of the fee schedule amount – ranging from 65 to 100 percent. For example, psychologists are paid 80 percent of the amount that a psychiatrist would be paid for the same service. However, we found that the percentage of services delivered by nonphysician practitioners over this period increased very little, so this is not a major source of divergence between the conversion factor increase and the average price per service. Finally, physicians who are not part of the Physician Participation Program are reimbursed at 95 percent of the fee schedule amount.

One of the components that feeds into the calculation of the changes in the conversion factor are changes in law or regulations projected to affect spending. These changes include specific legislative language that affects payments for groups of providers – for example, limits on payment for anesthesia teams and rules regarding the payment of nonphysician providers such as nurse practitioners. They also include changes in the package of services covered by Medicare. For example, Medicare began to cover a number of screening services in 1998. Another major component of these changes is the set of updates made to the physician fee schedule – these updates are described below and included in our analysis of changes in volume and intensity of services delivered. A list of the changes in law and regulation affecting payment for physicians' services is provided in Appendix F.

Table 18 summarizes the projected effects of these changes on expenditures for physicians' services. Over the period we examine, such changes were expected to have a cumulative effect of increasing expenditures by approximately 5 percent.

Together, the conversion factor used to update the physician fee schedule and law and regulation changes could have increased expenditures by approximately 23 percent. They did not, however, translate directly into a 23 percent increase in per capita expenditures because of the factors discussed above (the phase-in of the fee schedule, beneficiary cost-sharing) and changes in the volume and intensity of services delivered.

Changes in the Volume and Intensity of Services Delivered

The other major determinant of increases in expenditures is the increase in the volume and intensity of services delivered. Volume and intensity can increase or decrease as a result of changes in medical practice, changes in technology, changes in the case mix of the population being served, and other changes in the supply of and demand for physicians' services.

In the case of the physician fee schedule, volume and intensity can be measured using the Resource Based Relative Value Scale (RBRVS). As described in Appendix A, the RBRVS assigns each service on the physician fee schedule a number of relative value units (RVUs) that

¹⁸ Authors' analyses of MCBS claims data.

reflect the time, skill, expense, etc. of providing the service. We can thus quantify the volume and intensity using the number of RVUs delivered to beneficiaries over time.

We can also use updates to the RBRVS as a measure of changes in volume and intensity due to changing medical practices and technology. The RBRVS can change from year to year in two ways. First, the number of RVUs assigned to service codes can increase or decrease in quantity if the nature of a service changes. Second, codes and their associated RVUs can be eliminated or new codes can be added to account for new or outdated services. The RBRVS is updated through an annual review process (described below). Health Care Financing Administration (HCFA, now Centers for Medicare and Medicaid Services (CMS)) is also required to conduct a comprehensive review of the RBRVS scale every five years. Two such comprehensive reviews have occurred since the system was implemented in 1992, the first in 1996 (effective in 1997) and the second in 2001. Codes are also added to the fee schedule when services are added to the Medicare benefits package.

Changes to the RBRVS made by CMS are largely based on recommendations from physicians. A committee of medical professionals called the Specialty RVS Update Committee (RUC) advises CMS on changes to the RBRVS. The Committee is coordinated by the American Medical Association. The RUC has 29 members and the majority (20) are representatives of medical specialty societies. Physician specialty societies develop lists of services or procedures that they would like included in the RBRVS or updated in the RBRVS. They then survey samples of their members about those services to develop estimates of how much time and effort is involved in performing them. In the survey, respondents are asked to respond about the care of a “typical” case. Respondents are also asked to compare the service to other “reference” services for which codes exist in order to maintain the relative weighting of the entire system. Specialty societies then present the findings of their surveys and recommendations about the number of RVUs that the services merit to RUC. The RUC will only recommend a code change if there is agreement among two-thirds of RUC members about the change. The RUC reports annually to CMS, and CMS accepts about 95 percent of its recommendations (AMA, 2001). Examples of updates to the RBRVS are the 1997 and 1998 increases in the number of RVUs assigned to the highest-level evaluation and management office visit code for established patients (99215). This change presumably reflects the greater complexity of the sickest patients seen in an outpatient setting and decisionmaking about their care.

In order to keep the entire fee schedule “budget neutral” in the years 1993 through 1995 and 1997 HCFA (now CMS) made across-the-board percentage cuts in the number of RVUs assigned to each service to balance the new codes and updates.¹⁹ Medical societies protested that this worked against the intent of the resource-based system and caused problems for other payers using the RBRVS system. As a result, budget neutrality adjustments in 1996 and since 1997 have been made through the conversion factor.²⁰

The RBRVS system and the methods used to update it are, of course, imperfect. Specialty societies have no incentive to identify overvalued codes. Surveys done of new codes before they are well established may reflect additional time and effort associated with learning how to perform the new service or procedure. In addition, the population receiving a service may

¹⁹ The RVUs were cut by 2.8 percent in 1993, 1.3 percent in 1994, and 1.1 percent in 1995. The work RVUs were cut by 8.3 percent in 1997 after the five-year review.

²⁰ In addition, the 8.3 percent cut in the work RVUs was eliminated in 1999.

change over time, which could change the amount of work and expense associated with the service.

Nonetheless, we think that RVUs are the best available measure of volume and intensity. We base our analyses of changes in the volume and intensity of physicians' services on the number of RVUs delivered to Medicare beneficiaries over our study period. The next two sections describe our methods and our results. The results examine the implications of our findings for changes due to the composition of the Medicare population, the places of residence of Medicare beneficiaries, the sites where services are delivered, and changes in the technology applied to beneficiaries with conditions identified as having significant changes in the use of physicians' services.

Methods

We modeled the use of physicians' services using data from the 1993 MCBS and linked Medicare claims. Our strategy using the MCBS data was to track changes in the volume of services delivered by looking at changes in the number of RVUs worth of services consumed by beneficiaries over time.

The RBRVS was phased in over a five-year period beginning in 1992. We used 1993 as our base year since most of the changes due to the new payment system occurred in 1992 and thus 1993 is the first year for which a baseline level of physicians' services volume in terms of relative value units can be established (PPRC, 1994a). We chose 1998 as our reference year because it was the latest year for which MCBS data were available and because it reflects RVU use after the first major five-year review of the RBRVS in 1996.²¹

We constructed the baseline using data from the 1993 Medicare Current Beneficiary Survey (MCBS) Cost and Use File and linked claims data for MCBS respondents. The Medicare Current Beneficiary Survey is an annual rotating panel survey of Medicare beneficiaries. The Cost and Use File, which is available through 1998, contains information about respondents' demographics, health status, insurance coverage, and cost to the Medicare program. Using the claims data linked to the MCBS allowed us to look in detail at the exact mix of services (using CMS Common Procedural Coding System (HCPCS) codes, which can be matched to RVUs) that are being used over time. All figures we report are weighted using the MCBS cross-sectional weights.²²

We modeled the volume of services consumed (in RVUs) as a function of beneficiary characteristics. These characteristics were constructed from MCBS data elements. Demographic characteristics included age, gender, place of residence, education, and date of death. To capture beneficiary health status we included self-reported problems with activities of daily living (ADLs) and instrumental activities of daily living (IADLs), history of smoking, and

²¹ While we provide information below about the increases in RVU use between 1993 and 1998, we do not examine them in detail for a several reasons. First, the changes to the RBRVS schedule during these years were small. Thus, within-service technological change was mainly evaluated during the five-year review making the 1993 to 1998 comparison the most meaningful. Second, we were concerned that we could not fully account for the MCBS panel design and that our results would be confounded by beneficiaries appearing in the sample in multiple years. (This is not a problem with 1993 to 1998 comparisons since respondents are rotated out after four years.) Third, the across-the-board cuts in the RVUs, the different conversion factors for primary versus specialty care, etc. make interpreting the small year-to-year changes in patient categories extremely difficult.

²² Unweighted figures for our sample differ little from those reported (e.g. 1993 average RVUs were less than 1 percent higher).

history of having certain medical conditions.²³ We also used information about whether or not beneficiaries have employer-provided supplemental insurance, Medigap insurance, or Medicaid, since beneficiaries with reduced cost-sharing because of such coverage use more physicians' services (Lillard, 1999).²⁴ We include supplemental insurance status but not income in our models because the latter is extremely unreliable in the MCBS. The MCBS asks only a single question about total income for the respondent and spouse, if married. It misses income from other people, such as children, who may be living in the household and who can help pay some expenses. Second, combining all income into one question results in both a significant bias (typically under-reporting) and misreporting (Goldman and Smith, 2001). Changes in the volume of services delivered to beneficiaries resulting from differing practice patterns in the geographic locations where beneficiaries reside were captured using variables for urban versus rural residence and for census region.²⁵

We calculated the number of RVUs used by each beneficiary using claims data and a longitudinal database supplied to us by the American Medical Association. This database contained the RVUs assigned to each CPT code, by year. Using this information, we matched RVUs to each CPT code on the MCBS respondents' medical claims.²⁶

In summary, we fit an individual-level model of the following type to the 1993 MCBS data for beneficiaries in traditional FFS Medicare in order to estimate the baseline effects of demographics and case mix on the volume of services used by beneficiaries.

$$(2) \text{ Total 1993 RVUs}_i = f(\text{age}_i, \text{gender}_i, \text{age}_i * \text{gender}_i, \text{education}_i, \text{urban}_i, \text{region}_i, \text{insurance}_i, \text{ADLs} / \text{IADLs}_i, \text{smoked}_i, \text{conditions}_i)$$

²³ The medical conditions in the models and tables below are the conditions that are included in the MCBS survey. The MCBS asks about medical conditions at different levels of specificity: for example, it asks respondents which of their joints are affected by arthritis but doesn't differentiate between emphysema, asthma, and COPD. However, we felt that the benefit of having a consistently reported set of conditions that captured respondents' medical history and did not depend on respondents' use of care outweighed these limitations. In addition, we did fit the models using diagnoses from the beneficiaries' Part B claims instead of using their self-reported conditions. This did not change our results qualitatively.

²⁴ One might suspect that adverse selection would make the possession of insurance and the amount of expected expenditures endogenous. However, there is little evidence of adverse selection in the market for supplemental Medigap insurance once observable health status is controlled for (Lillard et al., 1999; Hurd and McGarry, 1997). This is due to the fact that Medigap coverage is effectively subsidized by the Medicare program and that Medigap insurance is frequently employer-provided.

²⁵ We investigated whether part of the increase could be due to changes in the geographic distribution of beneficiaries in the MCBS sample, since Medicare payments for physicians' services are adjusted by a set of geographic practice cost indices (GPCIs). We obtained sets of GPCIs for 1993-1998 and attempted to match them to our claims files. We were able to match only 84.4 percent of the line items in 1993 and 77.8 percent of the line items in 1998 to GPCIs using the carrier number and locality codes on the claims. Using an algorithm that assigned a GPCI based only on the provider's carrier or State yielded a match rate of 95.1 percent in 1993 and 91.4 percent in 1998. We then computed the mean GPCI value across the sample: the mean national value is 1.0. For 1993 it was 1.00 and for 1998 it was .99, indicating that the distribution of the MCBS sample across high and low cost areas is virtually identical to the national distribution.

²⁶ Anesthesia services were excluded from the RVU analyses and included in our analyses of other physicians' services since anesthesia services, unlike other physician fee schedule services, are paid using a system of base and time units.

All of the covariates were entered as indicator variables.²⁷ Beneficiaries reported a history of more than two medical conditions on average and were coded into each of those conditions (i.e., the condition categories are not mutually exclusive).

Medicare beneficiaries with ESRD or who were institutionalized at any point during the calendar year in question were excluded from the model, as were beneficiaries in Medicare HMOs or without Part B coverage for any part of the year. Medicare beneficiaries with ESRD were excluded because the monthly payments made to physicians for their management of ESRD patients were added to the RBRVS fee schedule in 1995. They thus would appear to have experienced a large increase in RVUs but in fact this was due only to a previously capitated service being added to the RBRVS fee schedule. Persons who were institutionalized were found to have different patterns of care use than noninstitutionalized persons: while they had higher-than-average use of RVUs, the variance in their RVU use was lower than that for almost all other patient categories.²⁸ Excluding these populations reduced our sample to 9,627 beneficiaries in 1993 and 8,986 beneficiaries in 1998. Per capita expenditures for our sample increased slightly more than for the entire MCBS FFS sample: they increased 19.5 percent (from \$898 to \$1073) over the 1993-1998 period we examined while the expenditures for the entire sample rose 15 percent.

After much experimentation, Model (2) was fit as a standard ordinary least squares (OLS) regression using the MCBS cross-sectional weights and robust standard errors to account for survey design effects. The coefficients from the model of RVU use are presented in Appendix B and are as expected. For example, many beneficiary attributes were associated with a greater use of services – including older age, major medical conditions, and higher educational attainment. The age and gender variables and interaction terms were included because they are frequently used predictors of Medicare services (e.g., the adjusted average per capita cost (AAPCC) payment rates for Medicare+Choice plans) and of specific interest to Congress. They are not, however, all significant in this framework given the inclusion of stronger predictors such as the condition categories (i.e., age is often a proxy for the presence of medical conditions).

We also fit Model (2) using a two-part model with a probit model for the probability of any RVU use as the first part and a log-linear OLS model for the second part. Estimates from this model were retransformed using Duan's smearing estimator (Duan, 1983). In addition, we fit a variety of two-part models using generalized linear models (GLMs) for the second part (Manning and Mullahy, 2001). We found that the two-part model with the GLM gamma function and a log link performed the best in terms of mean squared error and absolute prediction error. However, all of the models except for the OLS model overpredicted the mean of the 1993 sample and overpredicted RVU use by beneficiaries with major medical conditions. Since one of our major aims was to look at mean changes in use over time and by condition, we decided to use the standard OLS regression. (Regression coefficients from the two-part GLM gamma model are presented in Appendix C. They are similar to the OLS model in sign and relative magnitude.) In addition, we experimented with including interactions between major medical

²⁷ The indicator variables are: <65 years; 65-69 years; 70-74 years; 75-79 years; 80-84 years; 85+ years; Male; <65 years and male; 65-69 & male; 70-74 & male; 75-79 & male; 80-84 & male; 85+ & male; > High school education; Medicaid; Private supplement; Drug coverage; Urban residence; Northeast region; Midwest; South; West; Other region; zero ADLs; 1-2 ADLs; 3+ ADLs; zero IADLs; 1-2 IADLs; 3+ IADL; Ever smoked; Hardening of the arteries; Hypertension; Myocardial infarction; Angina pectoris/CHD; Other heart condition; Stroke/brain hemorrhage; Other cancer (not listed below); Skin cancer; Lung cancer; Colon cancer; Breast cancer; Prostate cancer; Diabetes; Arthritis; Alzheimer's; and no self-reported conditions.

²⁸ Institutionalized beneficiaries used 50 percent more RVUs on average in 1993 than non-institutionalized beneficiaries.

conditions since comorbidities could be important predictors of service use.²⁹ We found that the only interactions that were marginally significant were those between orthopedic conditions (hip fracture and osteoporosis) and some cancers and asthma/emphysema/chronic obstructive pulmonary disease (COPD).³⁰ However, these varied according to the way that comorbidities were specified, and the interaction terms as a group were not jointly significant.

Having fit our model to 1993 data, we then used the estimated coefficients from the 1993 model to generate predicted service volume in terms of RVUs for future years. We then compared the total predicted growth to the total volume growth to see how much of the change in volume could be attributed to the demographic and case-mix factors in the model.

We compared predicted RVU use to actual use in two ways. Using our AMA database, we assigned each claim in 1994-1998 two RVU values. One was based on the RVU schedule in place in 1993. The other was based on the RVU schedule in use during that year. By comparing the value based on the 1993 schedule to the value based on the current year schedule we quantified the extent to which the change in RVU use was due to new or updated codes versus an increase (or decrease) in the use of existing codes. Before doing this we adjusted the 1994 through 1998 codes upwards to account for the across-the-board cuts in the fee schedule made by CMS.

In doing this, we depend on the RBRVS update system to accurately reflect the intensity of new codes and changes in intensity within codes over time. If this is the case, then the difference between the use based on the 1993 fee schedule and later years' RVU usage reflects technological change in services delivered. The limitation of this approach is that there may be inaccuracies in the RBRVS system, lags between changes in delivery, and changes in assigned RVUs and other changes to the RBRVS system that fail to reflect technological changes. (This is discussed further below.)

We then analyzed the changes in the volume of RVUs billed over time for physicians' services and for the professional services of nonphysician practitioners. We decomposed this into the components due to changes in the composition of enrollment in the Medicare program and the components that can not be explained by population composition. We then examined the conditions that had use that differed substantially from the use predicted by our model in order to shed light on the unexplained component of volume growth. We also sought to disentangle changes in the use of existing services from the use of new services or services that had changed in intensity although we did not attempt to quantify the change due to physicians' coding practices. Lastly, for selected conditions that showed significant or unexpected changes in the use of services over time, we sought input from appropriate clinical experts for possible explanations of the observed changes.

Results

Table 19 presents descriptive statistics about the volume of physicians' services used by Medicare beneficiaries in 1993 versus 1998. It presents mean and median total RVUs used, as well as breakdowns of inpatient and outpatient RVUs used. It also stratifies use by beneficiaries

²⁹ Comorbidities were modeled using indicators for the number of other conditions interacted with each condition and by creating and interacting terms for six major types of conditions: orthopedic conditions, cardiovascular conditions, neurological conditions, diabetes, cancers, and respiratory conditions.

³⁰ The MCBS has a single response category for asthma/ emphysema/ COPD.

with and without a self-reported major medical condition. For 1998 it presents both the number of RVUs used and the number in terms of the 1993 RVU schedule.³¹ There was more than a 30 percent increase in the volume of physicians' services used by Medicare beneficiaries between 1993 and 1998 (from 38.1 to 49.9 RVUs.) There was no significant increase in the number of inpatient RVUs used, but a large increase in the use of physicians' services in outpatient settings. (Note: Laboratory RVUs are included in the total but not shown. They average less than one RVU per person in both 1993 and 1998.) There was significant increase in the use of services by both persons with and without self-reported medical conditions.

In 1993, 88.7 percent (weighted) of the sample used some physician services (Table 20). The rate was 89.8 percent in 1998. The average probability of any physician service use in 1998 predicted by the probit model developed on the 1993 sample is 89.0 percent. The characteristics of the population in 1998 are, therefore, consistent with a slightly higher probability of any use of physician services than the 1993 population, but both the predicted and actual rate changed very little.

However, conditional on use, beneficiaries used more services on average in 1998 than 1993. The second and third rows of Table 21 list 1993 and 1998 use. Both the mean and median number of services used increased, indicating that the increase was not due only to higher spending on the most severe cases. In addition, the last row of the table, predicted 1998 use, takes into account the changing demographics and health status of the Medicare population. All else being equal, the 1998 population as a whole would have been expected to use slightly fewer services.

RVU Use by Beneficiary Types

The 1.1 RVU difference between the predicted use of 37.0 RVUs by the 1998 sample and the use of 38.1 RVUs by the 1993 sample can be decomposed into components attributable to the observed beneficiary characteristics in the model. As shown in Table 22, a difference of 0.2 RVUs can be attributed to both the age/gender composition and the place of residence of the 1993 versus the 1998 samples. Specifically, the 1998 population has a greater proportion of disabled beneficiaries and beneficiaries in the oldest age category. Beneficiaries over age 85 use fewer RVUs worth of physicians' services than younger beneficiaries. Disabled beneficiaries also use fewer RVUs worth of services than other age groups, controlling for medical conditions. The use of RVUs by age/gender categories in 1993 and 1998 is presented in Appendix E. The 1998 population also has a lower proportion of beneficiaries living in urban areas and more beneficiaries living in the West, which contribute to lower predicted use. Other beneficiary characteristics are responsible for a net difference of 0.7 RVUs between 1993 and predicted 1998 use. These include lower rates of reported difficulties with ADLs and IADLs, and fewer beneficiaries with a history of heart attacks. (Appendix D presents the characteristics of the 1993 and 1998 sample populations.)

Table 23 shows the actual and predicted number of RVUs in each year between 1993 and 1998. The predicted RVUs are generated using model (2) described above. After increasing in

³¹ In all of the tables included in this report the reported "actual" number of RVUs used reflect the number of RVUs that would have been assigned to the service had CMS not made the across-the-board cuts in the RBRVS schedule. The fee schedule figures for 1998 are approximately five percent lower than those we report due to those cuts.

1994, predicted RVUs fall steadily from 1994 to 1998 with the evolving changes in the demographics of the Medicare population.

Comparing the second and third columns of Table 23 allowed us to decompose the change in RVU use. The first column is predicted 1994-1998 use based on the model developed on 1993 data, the second is 1994-1998 use based on the 1993 RVU schedule, the third is use in terms of the concurrent RVU schedule. The total change between the first and third columns ($49.9 - 37.0 = 12.9$) for 1998 can be decomposed into two components.

Increase in the use of existing codes. The difference between 1998 use based on the 1993 schedule and predicted 1998 use is 7.5 RVUs. This constitutes 58 percent of the total difference between 1993 and 1998 use ($7.5/12.9 = 58\%$). These 7.5 RVUs represent the increase in the use of codes that existed in 1993 by beneficiaries in 1998. This increase in the use of existing service codes could be caused by supply-side practice pattern changes such as improvements in the ability of physicians to provide such services. Such improvements could reflect a form of technological change. For example, physicians over this period might have been able to perform certain surgical procedures on older patients as their skill and experience with the procedure grew. It could also reflect demand-side changes as technologies mature and diffuse, wealth effects, or taste change.

Use of new or updated codes. The difference between 1998 actual use and 1998 use based on the 1993 schedule is 5.4 RVUs. This represents 42 percent of the total difference between 1998 use and predicted use. It can be explained by new technology substituting for old technologies, completely new technologies, newly covered services, or any adjustment of the 1993 RVU schedule due to changing intensity within service codes made by the RUC.

These patterns did vary somewhat by disease, as shown in Table 24. The predicted RVUs in this table come from applying the model (2) coefficients to the 1998 MCBS respondents. Table 24 is sorted from highest to lowest mean unexplained change in RVU use. At the top of the table are the conditions that saw unexplained increases in the volume of physicians' services such as osteoporosis and stroke. Decedents also experienced an increase in the use of existing services. At the bottom are the diseases that had lower unexplained growth. Some of these experienced treatment contraction – that is, a reduced use of the services available in 1993. Lung cancer patients, for example, used fewer established services in 1998 than 1993. This was due to a reduction in the use of physicians' services in the inpatient setting (as shown in Table 25 and discussed in more detail below.) All conditions saw some use of services that were either not available in 1993 or for which the number of RVUs increased between 1993 and 1998.

It is interesting to note, however, how few diseases had unexplained increases or decreases in RVU use that differed significantly from the mean increase in RVU use by persons without the condition. The conditions that had significantly higher unpredicted increases have a plus (+) next to them in Table 24, the conditions that had significantly lower increases have a minus (-) next to them. Of the self-reported medical conditions only three (plus decedents) had a significant unexplained increase in RVU use compared to people without those conditions. Two other patient types had significantly lower gains – hip fracture patients and patients without any reported conditions.³²

³² In addition, when the size of the critical region is adjusted to account for the fact that we are making multiple comparisons only the difference between persons with a condition and without any conditions is significant.

Site of Care Delivery

Consistent with commonly reported national trends, the increase in the use of outpatient services was much greater than the increase in the use of inpatient care. The proportion of RVUs associated with inpatient care declined from 36.7 percent to 29.9 percent of total RVU use. The total RVUs reported in Table 24 are the sum of RVUs delivered in inpatient settings and billed separately by physicians, services delivered in outpatient settings, and services related to diagnostic tests. The site of care delivery was determined using the place of service code listed on the physician bill. What little increase there was in inpatient settings largely came about because of the use of new or updated codes – these explain 86 percent of the unexplained increase in the inpatient use of RVUs. In addition, half of the conditions examined in Table 25 experienced declines in the use of existing services. In particular, lung cancer patients saw a large decline in their use of existing inpatient services. Of the patient types examined, only decedents received substantially more existing inpatient physicians' services in 1998 than in 1993. Decedents also received a particularly large number of new services. Stroke and osteoporosis patients who had high overall increases in RVU use also had higher unpredicted use of inpatient RVUs. Beneficiaries with a history of having broken a hip actually used fewer inpatient RVUs than predicted.

For outpatient services the overall trends were quite different. There was a mean increase of more than 10 RVUs in outpatient settings (Table 26). This increase was dominated by the enhanced use of existing codes, which accounted for 67 percent of the overall outpatient increase. Osteoporosis patients and stroke patients saw an increase in the use of outpatient RVUs that was higher than patients without these conditions, as did stroke patients. Beneficiaries with heart conditions other than those specifically mentioned on the MCBS survey (which were hypertension, hardening of the arteries, myocardial infarction, and angina/CHD) had significantly higher use. Lung cancer patients, who experienced declines in the use of inpatient RVUs, had high growth in the use of outpatient RVUs. Also notable was that Parkinson's patients saw a large unexplained increase while Alzheimer's patients used fewer outpatient RVUs than would have been predicted given 1993 baseline practice patterns. Colon cancer patients also had lower-than-average growth in the use of outpatient physicians' services.

Trends in sites of care delivery can cause changes in the number of RVUs paid for under the physician fee schedule. As described in Appendix A, the total number of RVUs assigned to a service is the sum of the practice expense, malpractice expense, and physician work RVUs associated with that service code. Practice expense RVUs for some services delivered in facilities are reduced relative to outpatient settings since the facility, rather than the physician, incurs the costs of staff, supplies etc. In other words, physicians receive a lower payment for providing these services in a facility than in their office. In 1993, out of the more than 8000 codes in our AMA databases 534 were subject to these site of service differentials; in 1998 675 were. However, when we assigned services delivered in the facilities the appropriate reduced number of RVUs, as opposed to the full number of RVUs that would have been assigned had the service taken place in an outpatient setting, it reduced our 1993 per beneficiary average number of RVUs by only 0.12. Applying the site-of-service differential in 1998 reduced the RVUs by 0.57. Therefore, while we cannot comment on the exact magnitude of site-of-care shifts given the different sets of services covered by the differential, if anything the site-of-service differential seems to have had the effect of reducing RVUs by more in 1998 than in 1993.

Changes in Clinical Technology and Productivity

Accordingly, we examined the patterns in the unexplained use of the RVUs overall, and in inpatient and outpatient settings, and chose a set of conditions for further study. We looked at conditions that had seen unusual growth or declines in RVU use. We also looked for those with increases in both percentage terms and absolute terms, those suffered by significant numbers of Medicare beneficiaries, and those that were sufficiently well defined to permit clinical experts to comment on them. These criteria led us to choose osteoporosis, stroke, and lung cancer for further examination.

The clinical experts offered the following as potential explanations for the observed changes in use:

Osteoporosis. Between 1993 and 1998 the use of the dual energy x-ray absorptiometry (DEXA) scan became reimbursable by Medicare for “persons at risk of osteoporosis” – a very large proportion of the Medicare population. This change in policy, combined with the development of new pharmaceutical therapy demonstrated to be effective in reducing fractures, led to an increase in the number of people identified and treated for osteoporosis. (Indeed, the reported prevalence of osteoporosis in the MCBS sample increased.) This probably also resulted in increases in physician office visits and radiology services. Additionally, the drugs mentioned above were the subject of direct-to-consumer advertising campaigns by pharmaceutical companies, which also likely increased patient demand for osteoporosis-related services.

Stroke. There was the development of a “new technology” for stroke between 1993 and 1998, the use of thrombolytic therapy for patients with acute stroke. However, the proportion of acute stroke patients receiving this therapy is so small that it cannot account for the increase in use during this time period. Rather, the clinical experts we surveyed reported that three factors likely contributed to the growth of RVUs used during this time period:

1. The greater appreciation of the value of aggressively treating risk factors for recurrent stroke. This led to increased physician office visits for management. Greater use of cholesterol-lowering agents, antiplatelet agents, and more aggressive blood pressure control were cited in particular.
2. The advent of improvements in the accuracy and convenience of imaging of the carotid arteries (magnetic resonance angiography and improvements in Doppler ultrasound) probably led to more of these examinations being performed and subsequent aggressive management of persons found to be at highest risk (including increased use of carotid endarterectomy).
3. A greater realization of the value of post-stroke rehabilitation at improving outcomes of patients with stroke, leading to increased use.

Lung Cancer. Unlike the two conditions listed previously, lung cancer had little overall change in RVU use but a large decrease in the use of existing services between 1993 and 1998, all of which was due to a decrease in hospital use. Three factors were postulated to be responsible for this observation:

1. Improvement in staging, leading to a reduction in the number of surgical resections (i.e., patients were shown to be inoperable for cure because of better imaging).
2. Shifts in the site of chemotherapy from the inpatient to the outpatient settings.

3. Increase in the use of hospice care, so that patients were not receiving terminal care in-hospital.

Effect of Medicare Managed Care Enrollment

During the period 1993-1998, there was a large increase in enrollment in Medicare managed care plans. The number of Medicare managed care enrollees grew from almost two million in 1993 to over 6 million in 1998 (16 percent of the Medicare population). Numerous studies have shown that there is favorable selection into Medicare HMOs: that is, that healthier-than-average beneficiaries choose to join such plans (see, for example, Medicare Payment Advisory Commission: *Improving Risk Adjustment in Medicare*. Washington, DC: November 2000). If this is the case, then part of the increase we see in the use of RVUs could be due to the healthier segment of the Medicare population enrolling in managed care plans. (Overall, our 1998 population is “healthier” in 1998 than it was in 1993, as evidenced by our lower predicted use of RVUs. However, it is possible that in the absence of HMO enrollment it would have been healthier still.)

In order to determine the magnitude of this effect we estimated the relative use of physicians’ services by Medicare managed care versus FFS enrollees. We had to estimate this difference because claims-level information about the use of physicians’ services by Medicare managed care enrollees is not collected by CMS nor by the MCBS survey. In addition, most previous research on the magnitude of selection between Medicare HMOs and FFS Medicare has been based on total costs or on the use of inpatient care. (We were not able to find estimates of the extent of differences in use of “physicians’ services.”) First, we used our regression model to predict RVU use based on the observed characteristics of the managed care enrollees. We applied the model to all beneficiaries enrolled in managed care plans at any point during 1993 or 1998, regardless of whether they had Part B coverage for the entire year. However, we did weight beneficiaries in the sample by the amount of time they were enrolled. We included these part-year enrollees because prior research has found that new Medicare HMO enrollees are particularly healthy (MedPAC, 2000).

We found that on the basis of observed characteristics, the managed care and FFS enrollees were predicted to have roughly the same amount of RVU use in both 1993 and 1998. Appendix D shows the distributions of the characteristics of the FFS and managed care populations. Compared to FFS, the managed care population is younger, has lower rates of problems with ADLs and IADLs, and has a lower prevalence of many (but not all) conditions. However, they are better educated and more urban, characteristics which are predictive of greater use.³³

In estimates of this kind, unobserved selection is always an issue. HMO enrollees may, for example, have systematically less severe heart disease or have preferences for less intensive care that are not captured in the model. We therefore estimated RVU use for the set of 1998 part-year HMO enrollees for which we had some information about their actual use of care. They were also estimated to have roughly the same average RVU use as the FFS sample (37.0 RVUs for the FFS sample and 37.3 for the part-year HMO enrollees.) However, those beneficiaries that

³³ In addition, we assumed that those with Medicare HMO coverage would have use comparable to those with privately purchased supplemental coverage in our FFS sample, which increases the predicted number of RVUs for these Medicare HMO enrollees.

enrolled in Medicare HMOs during 1998 incurred expenditure for physicians' services at half the rate of the average FFS beneficiary. (Their annualized expenditures were \$547 versus \$1073 for the average beneficiary remaining in FFS Medicare.) New, part-year HMO enrollees thus had unobserved characteristics that led them to spend 50 percent less on physicians' services than predicted during the period they were enrolled in fee-for-service Medicare.

For the Medicare managed care population as a whole, this 50 percent underprediction is probably an upper bound on the selection effect. First, it is for new enrollees who are known to have particularly low costs. Established enrollees likely have use that regresses towards a higher mean level of use. Second, no previous estimates of selection have been close to 50 percent in magnitude. Taking 50 percent as an upper bound on selection, the effect of increasing Medicare managed care enrollment over this period was at most a 5.6 percent increase in expenditures.³⁴ The lower bound on the selection effect from our model estimates was a negligible effect.

Other Physicians' Services

There are a number services not included on the standard RBRVS fee schedule that are nonetheless considered physicians' services and are included in the calculations of appropriate fee schedule updates under the MVPS and SGR. They are independent diagnostic laboratory and x-ray services (i.e. not hospital laboratories); anesthesia services; and certain health professionals, dressings, casts, and splints, and services and supplies provided incident to physicians' services.

Per beneficiary payments for all non-RVU services went up five percent, from \$317 in 1993 to \$333 in 1998 in our sample. As shown in Table 28, diagnostic labs and x-rays account for 67 percent of spending in this category in 1993 and nearly 75 percent in 1998. They are also the only type of non-fee schedule physicians' service that is used by a sufficiently large percentage of our sample of FFS beneficiaries to make fitting a model of use feasible. We fit a regression model to explain expenditures and service use for diagnostic tests that was similar to the model (2) fit for RVU use. This model is described below. We also present data below on the use of anesthesia services, a service used by 20 percent of our sample.

The mean number of per beneficiary health professional services did not change between 1993 and 1998, so the small increase in expenditures for health professional services in Table 27 translated into a small increase in the price paid per service. The use of services and supplies furnished incident to physicians' services went down considerably between 1993 and 1998 in our sample; however, very few beneficiaries used them so this is likely a statistical anomaly.

Much of the change in expenditures for non-RVU services is due to increased expenditures for diagnostic services. Table 27 presents the 1993 and 1998 actual, predicted, and unexplained changes in expenditures and use of diagnostic services. In terms of counts, diagnostic services use went up in 1998 for nearly all conditions. The overall mean count of services billed increased by 20 percent from 13.3 to 16.0. In dollar terms, laboratory and x-ray use increased by 16 percent but the unit price of diagnostic services went down over the period from an average of \$16 per lab to \$15.50. Unfortunately, there is no unit of service for diagnostic labs and x-rays

³⁴ This was calculated as follows: the FFS population was 94 percent of the total Medicare population in 1993. It was 84 percent of the total population in 1998. The 10 percent of beneficiaries who joined HMOs had spending of \$547 which was half the average level of spending (\$1073) of those who remained in FFS. Thus, the effect on the average spending of the FFS pool was $1/[(.84*1)+(.10*.5)]/94=1.056$ times higher than expenditures would have been for the entire pool including the HMO enrollees.

comparable to RVUs so it is difficult to determine which conditions saw increases in the “volume” of diagnostic tests. Nonetheless, some of the same small set of conditions that experienced RVU use increases also experienced growth in the use of labs and x-rays, including stroke patients and osteoporosis patients. Lung cancer patients, who saw an increase in their use of outpatient services, also used more services in this category.

Less anesthesia was used in 1998 than in 1993 overall, and less was used in the treatment of quite a few conditions. Lung, colon, breast, and prostate cancer patients used fewer units of and spent less on anesthesia services. Decedents had a slightly greater number of bills for anesthesia and their increase in spending on anesthesia was high relative to other conditions. (See Table 29.)

Discussion

In our sample of Medicare beneficiaries, per capita expenditures for physicians’ services increased 19 percent in nominal dollars from \$898 to \$1073 over the period 1993-1998. Expenditures for physician fee schedule services increased 27 percent from \$581 to \$740, and other services included in the statutory definition of physicians’ services increased 5 percent from \$317 to \$333. The physician fee schedule dollar conversion factor increased by 19 percent from \$31.50 to \$37.60.³⁵

Changes due to law and regulation and increasing enrollment in managed care can account for at most one-half of this change in expenditures. According to CMS, changes in laws and regulation should have led to increases of 5 percent in total expenditures for physicians’ services. We estimate that HMO enrollment can explain at most a 5.6 percent increase in expenditures.

We found that the volume of physicians’ services delivered to non-ESRD, non-institutionalized fee-for-service Medicare beneficiaries, measured using the RBRVS, increased 30 percent over the mid-1990s. Our analyses do not indicate that this is due to measurable changes in the demographic composition of the Medicare population, places of residence, the prevalence of health conditions, or other beneficiary characteristics. Indeed, our analysis indicates that all else being equal, the FFS population in 1998 should have used slightly fewer RVUs than the 1993 population. In addition, while we found that the use of services in outpatient settings increased substantially, this increase could not be directly attributed to shifts in site of care from inpatient to outpatient settings.

In fact, the evidence suggests increased use of physicians’ services by every type of Medicare beneficiary that we examined. We had hypothesized that conditions in which there had been rapid technological change would see the greatest increases, but there was evidence of technological change across all conditions. When we queried clinical experts about the determinants of changes in use for selected medical conditions, they pointed to a number of changes in medical knowledge and technology that could have contributed, indicating that within conditions the impact of new technologies is also diffuse.

³⁵ Note, however, that conversion factor increase does not translate into a commensurate increase in expenditures owing to beneficiary cost-sharing, the phase-in of the fee schedule, and other factors discussed in detail above.

Table 18. Projected percentage increase in expenditures for physicians' services resulting from changes in law or regulations

Legislative Factors	1994	1995	1996	1997	1998	Cumulative Change
All services / weighted average	2%	3.5%	-0.5%	-0.7%	0.6%	4.9%
Surgical	1.4%	5.3%	-0.6%	-2.1%		
Primary care	3.2%	9.5%	5.7%	3.4%		
Nonsurgical	1.9%	-2.7%	-2.4%	-1.5%		

Source: *Federal Register* Notices.

Table 19. RVU use by year and service categories, 1993 & 1998

Type of Beneficiary	Number of Observations	1993 RVUs						Number of Observations	1998 Based on 1993						1998 Actual					
		Total RVUs		Outpatient		Inpatient			Total RVUs		Outpatient		Inpatient		Total RVUs		Outpatient		Inpatient	
		mean	median	mean	median	mean	median		mean	median	mean	median	mean	median	mean	median	mean	median	mean	median
All	9627	38.1 (.80)	14.1	23.6 (.50)	11.7	14.0 (.59)	0.0	8,986	44.5 (1.83)	16.6	30.8 (1.61)	14.0	13.1 (.54)	0.0	49.9 (1.68)	20.6	34.2 (1.37)	17.2	14.9 (.62)	0.0
Beneficiaries with conditions	8787	40.6 (.89)	15.6	25.0 (.54)	13.1	15.1 (.67)	0.0	8,277	46.9 (1.99)	18.5	32.4 (1.76)	15.2	13.8 (.58)	0.0	52.5 (1.82)	22.8	36.0 (1.50)	18.6	15.7 (.67)	0.0
Beneficiaries without conditions	840	14.3 (1.14)	2.6	10.4 (.69)	2.6	3.8 (.67)	0.0	709	18.9 (1.84)	3.7	13.2 (1.32)	3.4	5.5 (1.26)	0.0	21.5 (1.91)	4.6	14.9 (1.24)	4.2	6.3 (1.41)	0.0

Note: For mean total RVUs and outpatient RVUs, the increases over time are all significant at $p=0.05$. The change in inpatient RVUs is not significant. For mean total RVUs and outpatient RVUs, the difference between beneficiaries with and without conditions are all significant at $p=0.05$. Standard errors are in parentheses.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 20: Probabilities of any use of physicians' services

	Number of Observations	Mean
Rate of use in 1993	9,627	0.887
Rate of use in 1998	8,986	0.898
Predicted rate of use in 1998	8,986	0.890

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 21: RVU consumption for physician services

	Mean	Median¹	Number of Observations
1993 use	38.1	14.1	9,627
1998 use	49.9	20.6	8,986
1998 use based on 1993 RVUs	44.5	16.6	8,986
1998 predicted use based on 1993 model	37.0	33.2	8,986

¹ Comparing the median prediction to the median use demonstrates that our model does not mirror the distribution of the actual data. However, as discussed in the text, alternative modeling strategies introduced unacceptable levels of bias.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 22: Decomposing the predicted change in RVU for physician services use

	RVUs	Difference
1993 use	38.1	
1998 predicted	37.0	-1.1
1998 predicted holding 1993 age/gender distribution constant	37.9	-0.2
1998 predicted holding 1993 residence constant	37.9	-0.2
1998 predicted holding 1993 health status and other characteristics constant	37.3	-0.7

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 23: RVU for physician services use by year

Year	Predicted RVU Use	RVUs Based on 1993 Schedule	Actual RVU Use	Mean Unexplained Change	Existing Codes	New and Updated Codes	Number of Observations
	(1)	(2)	(3)	(3) minus (1)	(2) minus (1)	(3) minus (2)	
1993	38.1	38.1	38.1	-	-	-	9,627
1994	38.5	41.6	41.5	3.0	3.0	0.0	9,857
1995	38.0	42.6	42.6	4.6	4.6	0.0	8,978
1996	37.5	47.9	47.3	9.8	10.3	-0.6	8,655
1997	37.3	46.6	51.4	14.1	9.3	4.8	8,881
1998	37.0	44.5	49.9	12.9	7.5	5.4	8,986

Note: The new and updated code effect for 1996 is -0.6. This is because, while the median RVU use in 1996 was higher than the median use based on the 1993 schedule by 0.4 RVUs (due to the addition of new codes and the updating of existing ones) the mean value is lower. This is likely due to devaluing over the period 1994-1996 of the practice expense RVUs for certain services, largely provided in inpatient settings, that were thought to be overvalued.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 24: Differences between predicted and actual use of RVUs for physician services in 1998, sorted from highest to lowest unexplained change

	RVUs						Existing Codes		New and Updated Codes		
	Actual 1993 Use	Predicted 1998 Use	1998 Based on 1993 Schedule	1998 Actual Use	Mean Unexplained Change		Effect Size	(% change)	Effect Size	(%)	Number of Observations in 1998
		(1)	(2)	(3)	(3)-(1)		(2)-(1)	[(2)-(1)]/(2)	(3)-(2)	[(3)-(2)]/(2)	
Decedent	92.6	90.9	111.1	125.5	34.6	+	20.3	18.2%	14.4	12.9%	339
Parkinson's	44.9	43.9	57.5	67.7	23.8		13.6	23.7%	10.2	17.8%	139
Osteoporosis	43.5	39.4	55.0	60.8	21.4	+	15.6	28.4%	5.8	10.5%	1,267
Stroke/brain hemorrhage	46.3	43.8	56.3	65.1	21.3	+	12.5	22.2%	8.8	15.7%	1,039
Other heart condition	52.5	50.4	60.2	67.7	17.3	+	9.7	16.2%	7.5	12.5%	2,647
Breast cancer	53.1	51.6	64.3	68.5	16.9		12.7	19.7%	4.2	6.5%	355
Angina pectoris/CHD	57.3	55.7	63.1	71.6	15.9		7.4	11.7%	8.5	13.5%	1,326
Hypertension	43.0	42.2	51.1	56.9	14.7		8.8	17.2%	5.8	11.5%	4,965
Myocardial infarction	60.5	58.4	64.4	73.0	14.6		6.0	9.4%	8.6	13.3%	1,350
Arthritis	42.4	40.9	49.8	55.1	14.2		8.9	17.9%	5.3	10.7%	5,438
Diabetes	53.1	51.1	56.9	64.9	13.8		5.8	10.1%	8.0	14.0%	1,462
Emphysema, asthma, COPD	47.4	46.7	53.0	60.4	13.7		6.3	11.9%	7.4	14.1%	1,407
Skin cancer	45.0	44.2	51.1	57.8	13.6		6.9	13.5%	6.7	13.1%	1,596
Hardening of the arteries	54.3	54.6	59.7	67.6	13.0		5.1	8.5%	7.9	13.3%	1,106
Mental disorder	40.0	37.9	37.7	49.8	11.9		-0.1	-0.4%	12.1	32.0%	883
Other cancer (not listed below)	47.8	46.5	50.3	57.8	11.3		3.8	7.6%	7.5	14.8%	495
Prostate cancer	69.9	67.2	66.9	75.6	8.4		-0.4	-0.6%	8.7	13.1%	269
Alzheimer's	42.7	45.8	44.4	52.3	6.5		-1.4	-3.1%	7.9	17.8%	251
Broken hip	54.5	54.3	51.9	59.7	5.4	-	-2.4	-4.6%	7.8	15.0%	456
No self-reported conditions	14.3	17.2	18.9	21.5	4.3	-	1.8	9.4%	2.6	13.5%	709
Lung cancer	109.8	109.5	103.6	113.8	4.3		-5.8	-5.6%	10.2	9.8%	89
Colon cancer	63.5	64.2	59.5	68.2	4.0		-4.7	-7.9%	8.7	14.6%	227
MEAN	38.1	37.0	44.5	49.9	12.9		7.5	16.8%	5.4	12.1%	8,986

- Mean unexplained change for people with condition significantly lower than residual for people without condition at $p < 0.05$.

+ Mean unexplained change for people with condition significantly higher than residual for people without condition at $p < 0.05$.

CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 25: Differences between predicted and actual use of RVUs in 1998, inpatient

INPATIENT							Existing Codes		New and Updated Codes		
	Actual 1993 Use	Predicted 1998 Use	1998 Based on 1993 Schedule	1998 Actual Use	Mean Unexplained Change		Effect Size	(% change)	Effect Size	(%)	Number of Observations in 1998
		(1)	(2)	(3)	(3)-(1)		(2)-(1)	[(2)-(1)]/(2)	(3)-(2)	[(3)-(2)]/(2)	
Hardening of the arteries	22.2	21.5	22.1	25.1	3.7		0.6	2.8%	3.1	13.8%	1,106
Hypertension	16.9	15.7	16.1	18.3	2.6		0.4	2.6%	2.2	13.5%	4,965
Myocardial infarction	29.8	27.7	25.8	29.8	2.1		-1.9	-7.3%	3.9	15.2%	1,350
Angina pectoris/CHD	25.2	23.4	22.4	25.9	2.5		-1.1	-4.7%	3.5	15.8%	1,326
Other heart condition	23.1	21.2	20.5	23.7	2.5		-0.7	-3.5%	3.2	15.4%	2,647
Stroke/brain hemorrhage	20.8	18.6	24.4	28.0	9.4	+	5.9	24.1%	3.5	14.5%	1,039
Other cancer (not listed below)	19.2	17.7	16.0	18.2	0.5		-1.8	-11.0%	2.2	14.0%	495
Skin cancer	15.1	13.8	13.0	14.9	1.0		-0.8	-6.4%	1.9	14.4%	1,596
Lung cancer	52.8	50.4	32.7	36.8	-13.6	-	-17.7	-54.0%	4.1	12.6%	89
Colon cancer	25.9	26.4	24.4	27.3	0.9		-2.0	-8.1%	2.9	11.9%	227
Breast cancer	14.1	12.8	12.5	14.0	1.2		-0.3	-2.4%	1.5	12.3%	355
Prostate cancer	19.8	17.8	20.6	23.1	5.3		2.9	13.8%	2.5	12.0%	269
Diabetes	22.1	20.0	20.7	23.5	3.5		0.7	3.6%	2.7	13.2%	1,462
Arthritis	15.2	13.8	13.9	15.8	2.0		0.1	0.5%	1.9	13.8%	5,438
Alzheimer's	12.3	13.9	18.4	20.7	6.8		4.5	24.7%	2.3	12.2%	251
Mental disorder	12.2	10.6	12.0	14.6	4.0		1.4	11.8%	2.6	21.5%	883
Osteoporosis	12.7	10.0	14.6	16.4	6.4	+	4.6	31.8%	1.8	12.1%	1,267
Broken hip	26.8	26.5	20.8	23.8	-2.7		-5.7	-27.2%	3.0	14.3%	456
Parkinson's	18.4	18.7	18.2	20.0	1.3		-0.5	-2.5%	1.7	9.5%	139
Emphysema, asthma, COPD	18.9	18.3	19.2	21.9	3.7		0.9	4.6%	2.8	14.4%	1,407
No self-reported conditions	3.8	4.7	5.5	6.3	1.7		0.8	14.9%	0.8	15.2%	709
Decedent	66.5	65.4	78.0	88.2	22.8	+	12.6	16.2%	10.2	13.0%	339
MEAN	14.0	12.9	13.1	14.9	2.1		0.2	1.6%	1.8	14.1%	8,986

- Mean unexplained change for people with condition significantly lower than residual for people without condition at $p < 0.05$.

+ Mean unexplained change for people with condition significantly higher than residual for people without condition at $p < 0.05$.

CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 26: Differences between predicted and actual use of RVUs in 1998, outpatient

OUTPATIENT	RVUs					Existing Codes		New and Updated Codes		Number of Observations in 1998
	Actual 1993 Use	Predicted 1998 Use	1998 Based on 1993 Schedule	1998 Actual Use	Mean Unexplained Change	Effect Size	(% change)	Effect Size	(%)	
		(1)	(2)	(3)	(3)-(1)	(2)-(1)	[(2)-(1)]/(2)	(3)-(2)	[(3)-(2)]/(2)	
Hardening of the arteries	31.7	32.7	36.6	41.4	8.7	3.9	10.7%	4.8	13.1%	1,106
Hypertension	25.7	26.1	34.1	37.7	11.6	8.0	23.5%	3.6	10.4%	4,965
Myocardial infarction	30.3	30.3	37.7	42.2	11.9	7.4	19.6%	4.5	11.9%	1,350
Angina pectoris/CHD	31.6	31.7	39.6	44.5	12.8	7.9	20.0%	4.8	12.2%	1,326
Other heart condition	29.0	28.7	38.7	43.0	14.3	+	10.0	4.3	11.0%	2,647
Stroke/brain hemorrhage	25.1	24.8	30.6	35.7	11.0	5.9	19.2%	5.1	16.6%	1,039
Other cancer (not listed below)	28.1	28.3	33.1	38.2	9.9	4.9	14.8%	5.0	15.1%	495
Skin cancer	28.7	29.2	37.0	41.8	12.6	7.8	21.1%	4.8	13.0%	1,596
Lung cancer	56.8	58.8	70.4	76.4	17.7	11.6	16.5%	6.1	8.6%	89
Colon cancer	36.4	36.6	33.8	39.5	2.9	-	-2.7	5.7	16.8%	227
Breast cancer	38.5	38.4	51.3	53.8	15.4	12.9	25.1%	2.5	4.9%	355
Prostate cancer	49.7	49.0	44.8	50.9	2.0	-4.2	-9.3%	6.1	13.7%	269
Diabetes	30.3	30.5	35.4	40.6	10.1	4.9	13.9%	5.1	14.5%	1,462
Arthritis	26.8	26.6	35.1	38.5	11.9	8.5	24.3%	3.4	9.7%	5,438
Alzheimer's	30.1	31.4	25.0	30.5	-0.9	-	-6.4	5.5	21.8%	251
Mental disorder	27.4	26.9	25.2	34.4	7.6	-1.7	-6.7%	9.3	36.7%	883
Osteoporosis	30.4	29.0	39.5	43.4	14.3	10.4	26.4%	3.9	9.9%	1,267
Broken hip	26.8	26.9	29.1	33.5	6.6	2.3	7.8%	4.4	15.0%	456
Parkinson's	25.9	24.5	38.2	46.6	22.1	13.7	35.8%	8.4	22.0%	139
Emphysema, asthma, COPD	28.1	28.1	33.0	37.5	9.5	4.9	14.9%	4.6	13.8%	1,407
No self-reported conditions	10.4	12.2	13.2	14.9	2.7	-	1.0	1.7	12.5%	709
Decedent	24.8	24.1	30.6	34.5	10.4	6.5	21.2%	3.9	12.8%	339
MEAN	23.6	23.7	30.8	34.2	10.5	7.1	23.0%	3.4	11.1%	8,986

- Mean unexplained change for people with condition significantly lower than residual for people without condition at $p < 0.05$.

+ Mean unexplained change for people with condition significantly higher than residual for people without condition at $p < 0.05$.

CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 27: Mean per beneficiary payments for non-RVU services, 1993 and 1998

	1993 Mean Payments per Beneficiary in Dollars	1998 Mean Payments per Beneficiary in Dollars
Anesthesia	30.97	32.86
Diagnostic laboratory and x-ray	213.51	248.15
Health professionals	15.34	18.85
Incident to services	40.87	6.95
Dressings, casts, splints	0.001	0.002
Total non-RVU services	317.47	333.37

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 28: Differences between predicted and actual use of and expenditures for diagnostic labs and x-rays in 1993 and 1998

Diagnostic Labs and X-rays	1993 Payment (current dollars)	Predicted 1998 Payment: OLS Model	1998 Payment (current dollars)	Mean Unexplained Change	1993 Counts	Predicted 1998 Counts: OLS Model	1998 Counts	Mean Unexplained Change	Number of Observations 1998
		(1)	(2)	(2)-(1)		(3)	(4)	(4)-(3)	
Hardening of the arteries	313.3	316.4	372.4	56.0	17.9	18.1	22.6	4.5 +	1106
Hypertension	247.6	243.4	280.8	37.4	15.3	15.3	18.4	3.1	4965
Myocardial infarction	340.1	330.4	365.0	34.5	19.0	18.6	22.8	4.2	1350
Angina pectoris/CHD	336.9	327.1	408.0	80.9 +	19.3	18.9	24.7	5.8 +	1326
Other heart condition	310.7	300.4	352.9	52.5	18.5	18.2	22.1	3.9 +	2647
Stroke/brain hemorrhage	255.8	245.3	313.5	68.1 +	15.8	15.6	21.8	6.3 +	1039
Other cancer (not listed below)	268.7	264.7	298.9	34.2	15.5	15.6	20.2	4.6	495
Skin cancer	247.1	245.1	315.7	70.6 +	15.2	15.3	19.1	3.9	1596
Lung cancer	454.2	468.8	644.3	175.5	24.4	25.6	39.3	13.7	89
Colon cancer	344.9	343.0	339.6	-3.4	19.3	19.4	20.6	1.2	227
Breast cancer	280.4	275.3	344.1	68.8	17.8	18.0	20.5	2.5	355
Prostate cancer	383.6	380.2	360.5	-19.7 -	21.3	21.1	23.6	2.5	269
Diabetes	312.5	302.8	328.7	25.9	20.2	19.9	24.6	4.7 +	1462
Arthritis	238.0	230.9	275.1	44.2	14.8	14.7	17.7	3.0	5438
Alzheimer's	268.6	282.5	292.3	9.8	17.6	18.8	18.2	-0.5 -	251
Mental disorder	202.1	192.3	221.6	29.3	12.8	12.5	14.7	2.2	883
Osteoporosis	258.8	239.0	298.7	59.7	16.9	16.1	19.5	3.4	1267
Broken hip	228.0	224.2	273.1	49.0	15.7	15.9	19.3	3.4	456
Parkinson's	263.4	253.9	310.8	56.9	15.9	16.0	18.4	2.4	139
Emphysema, asthma, COPD	252.9	248.0	296.8	48.7	15.5	15.4	19.0	3.6	1407
No self-reported conditions	79.8	96.8	91.4	-5.4 -	5.0	6.5	5.9	-0.6 -	709
Decedent	351.1	341.4	408.2	66.8	22.9	22.8	26.1	3.3	339
MEAN	213.5	208.9	248.2	39.3	13.3	13.2	16.0	2.8	8986

- Mean unexplained change for people with condition significantly lower than residual for people without condition at $p < 0.05$.

+ Mean unexplained change for people with condition significantly higher than residual for people without condition at $p < 0.05$.

CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease.

Source: Authors' analyses of Medicare Current Beneficiary Survey.

Table 29: Differences between predicted and actual use of and expenditures for anesthesia in 1993 and 1998

Anesthesia	1993 Payment (current dollars)	1998 Payment (current dollars)	Change	1993 Counts	1998 Counts	Change	Number of Observations 1998
	(1)	(2)	(2)-(1)	(3)	(4)	(4)-(3)	
Hardening of the arteries	43.9	45.4	1.5	22.8	20.2	-2.6	1106
Hypertension	34.6	36.8	2.3	18.2	17.0	-1.1	4965
Myocardial infarction	46.3	47.9	1.6	21.8	24.4	2.6	1350
Angina pectoris/CHD	45.5	47.4	1.8	20.7	19.5	-1.2	1326
Other heart condition	43.1	43.6	0.5	21.5	20.6	-0.9	2647
Stroke/brain hemorrhage	33.2	41.0	7.8	17.1	20.5	3.4	1039
Other cancer (not listed below)	39.1	52.5	13.4	24.4	22.6	-1.8	495
Skin cancer	32.3	35.5	3.3	16.5	16.7	0.2	1596
Lung cancer	95.5	75.4	-20.2	45.2	26.1	-19.1	89
Colon cancer	62.0	57.6	-4.4	33.8	23.0	-10.8	227
Breast cancer	41.4	40.6	-0.8	22.4	14.4	-8.0	355
Prostate cancer	58.2	57.6	-0.6	32.6	29.2	-3.3	269
Diabetes	40.8	42.0	1.2	20.2	18.4	-1.8	1462
Arthritis	34.2	36.3	2.2	19.0	16.9	-2.1	5438
Alzheimer's	23.1	21.4	-1.7	6.8	8.6	1.8	251
Mental disorder	21.5	26.7	5.2	8.6	13.4	4.8	883
Osteoporosis	28.5	38.1	9.6	12.8	19.9	7.1	1267
Broken hip	34.8	44.4	9.6	18.9	24.6	5.7	456
Parkinson's	30.5	26.6	-3.9	13.7	15.4	1.7	139
Emphysema, asthma, COPD	36.7	38.6	2.0	18.0	18.4	0.4	1407
No self-reported conditions	14.7	16.4	1.7	7.1	5.7	-1.5	709
Decedent	73.9	86.5	12.5	36.8	37.4	0.7	339
MEAN	31.0	32.9	1.9	16.5	14.7	-1.8	8986

CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease.

Note: Anesthesia was used so infrequently that a model for its use could not be fit reliably; no predicted values or "unexplained changes", therefore, are included in this table.

Source: Authors' analyses of Medicare Current Beneficiary Survey.